ABSTRACT

A receiver in a code-division, multiple-access (CDMA) communication system employs a preamble detector for random access channels (e.g., RACHs). RACHs may use orthogonal Gold code (OGC) sequences for preamble signature sequences and/or

5   spreading of the preamble signature sequence with OGC sequences. A preamble detector may employ a fast orthogonal Gold transform (FOGT) for both despreading (e.g., correlation with code numbers $C1,\ldots,C256$)) and for generating a decision statistic for detecting (identifying) the signature sequence used in the preamble. The spread signal of the RACH is applied to a code matched filter (CMF) matched to the spreading OGC

10   sequence and the output signal of the CMF is sampled at the symbol rate. A fast Hadamaard transform (FHT) is applied to the sampled output of the CMF, and the exemplary 16th order code-words of the FHT match the 16 Walsh signature sequences employed to distinguish user channels transmitted by user equipment. A fast OGC transform (FOGT) may be applied to the sampled output of the CMF if OGC sequences

15   are used as signature sequences. The signals generated by the FHT may be split into two branches for processing: a reference branch and a data branch. The reference branch processes the FHT generated signals to estimate channel response characteristics, provide a de-rotation signal, and perform frequency acquisition if required. For the reference branch, the squared magnitude of each complex FHT vector signal of length 16 is

20   calculated and the maximum value is set as index i, where i, $\{1,\ldots\ldots16\}$. The maximum index i is employed as a preliminary, non-coherent decision statistic corresponding to the index value of the Walsh signature sequence used for the spread signal of the access channel. The index i of the reference branch may then be used by: 1) a Walsh generator to reproduce the Walsh (BPSK) signature sequence; 2) a selector to select one of the 16

25   FHT output signals to estimate channel response characteristics; and 3) as a non-coherent decision statistic for subsequent processing by the detector.